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TWO-WIRE SOLID STATE DIRECT TOUCH RESPONSIVE SEMICONDUCTOR SWITCH CIRCUIT

Alexander Michael Adelson, Elmsford, and Jerome Swartz, Elmhurst, N.Y., assignors, by mesne assignments, to Hall-Barkan Instruments, Inc., Tuckahoe, N.Y., a corporation of New York

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ABSTRACT OF THE DISCLOSURE

A two-wire solid state touch responsive switch circuit that includes an SCR having a gate sensitivity not exceeding 10 microamperes. An essentially resistive load is connected in series with a power source and the anode and cathode of the SCR. A capacitor and a resistor are connected in parallel between a gate of the SCR and the cathode of the SCR, the values of the capacitor and resistor being chosen to preferentially reject AC voltage on an actuating foreign body. A touch responsive element is connected through a resistor to the SCR gate so that when touched by the foreign body the ambient AC voltage on the body picked up from ambient AC sources fires the SCR.

This invention relates to electronic switches and more particularly to a two-wire solid state switch circuit which is actuated to the active state to close a load circuit in response to the touch of a human body or its electrical equivalent.

In the past, touch responsive switches have depended upon the internal power supply for their switching action signal drive. It is an object of the present invention to remove the individual from the feedback-voltage divider loop, commonly used in prior art devices, so that triggering depends only upon an externally available ambient drive essentially entirely independent of the internal power supply voltage, frequencies, regulation, etc.

Moreover, it is an object of the invention to provide a construction of touch responsive switch having relatively few components, which is simple and compact in construction, economical to manufacture and compatible with mass production techniques. The switch of the present invention utilizes a highly current sensitive semiconductor element, such as a semiconductor controlled rectifier, as a switching element which is responsively triggered into a state of conduction upon contact by the finger of a human operator, or some other electrically equivalent external operator, through an antenna element connected in the four-layer device trigger circuit. The basic mode of touch operation of the switch depends essentially upon the capacitively-coupled voltage pick-up of the human body, 60 cycles typical, for the touch responsive triggering operation.

Another object of the present invention is to provide a construction of electronic switch which has no moving parts, and indefinitely long operating lifetime as established by well beyond 20,000,000 firings or cycling operations of the switch of the invention with no appreciable change in reliability or performance; additionally, the switch eliminates contact bounce, contact sticking, and burning and wear associated with conventional mechanical and electro-mechanical switches.

A further object of the invention is to provide a construction of touch responsive solid state switch which is fast in switching between states, in the microsecond range, is isolated from the control signal, and produces essentially no external transient effects during typical cycling operations.

Still another object of the invention is to provide a simply constructed compact semiconductor switch which can be operated as an AC momentary switch or a DC latching switch, for utilization whenever a simple switching action is required, and to drive more sophisticated and/or higher power switching circuits.

Still a further object of the invention is to provide a touch responsive switch having a high ratio of OFF-ON resistance, approximately 10^8:1, with essentially no current drain in the OFF state, and with only a slight voltage drop or power dissipation in the ON state.

Other and further objects of the invention reside in the manner in which the human operator, or mechanical foreign body, is utilized in an antenna circuit portion of the semi-conductor switch to trigger the switch into producing a momentary switching action or a latching switching action. Other objects reside in the switch characteristics of distortionless wave-form transmission, essentially unlimited innate frequency response (band width limited by power source only), and the avoidance of load sensitivity as a prime factor of switch operation. Other and additional objects of the invention are set forth more fully in the specification hereinafter following by reference to the accompanying drawings, in which:

FIG. 1 is a perspective view of the switch of the invention and particularly showing a preferred arrangement of the touch contact antenna;

FIG. 2 is an electrical schematic of the touch activated AC momentary switch of the invention;

FIG. 3 is a modified form of the switch of FIG. 2;

FIG. 4 is another modified form of the switch of FIG. 1;

FIG. 5 is an electrical schematic of a DC version of the switch of FIG. 1; and

FIG. 6 is a further modified form of the circuit of the invention for increasing the power-handling capability of the touch actuated switch.

Referring to the drawings in greater detail, a perspective view of the novel switch is shown in FIG. 1, which consists of a body portion or housing **1** of electrical insulation material, such as plastic or the like, having an electrically conductive element or antenna **2** forming the front surface of the housing. Under certain conditions, antenna **2** which forms the touch activation surface for the switch may be a solid sheet of electrically conductive material such as stainless steel, but an alternate construction of the antenna element **2** is shown in FIG. 1. as consisting of a plurality of electrically conductive parallel finger-like elements **3**, commonly connected by conductor **4** at one end, intermeshed in spaced relation with another set of electrically conductive parallel finger-like elements **5** commonly connected by conductor **6**. Elements **3**, **4**, **5** and **6** are connected on a base portion **7** of electrical insulation material and the entire antenna element **2** may be formed from a printed circuit board. If the base portion **7** is constructed of translucent or transparent material, a lamp (not shown) may be located behind the base portion, interior of housing, **1** along with the other circuit elements, to illuminate antenna element **2** from behind upon actuation of the switch.

The circuit components of the switch within housing **1** may be mounted on a printed circuit board with the circuit terminating in a pair of electrical terminals **8** and **9** protruding from the back of housing **1** for connecting the switch into an external electrical circuit. The electrical circuit of the four-layer semiconductor touch switch of the invention, which is a half-wave AC momentary action switch is shown in FIG. 2. This switch is operated as a momentary action switch by supplying the anode with an AC voltage source. Voltage pick-up by the human body or other external object touching the antenna ele-